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# A NOTE ON THE COLORATION OF PLETHODON CINEREUS

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ON September 9, 1905, Mr. A. A. Allen found, near Buffalo, N. Y., a salamander[1] 6.5 cm. long which was, at first sight, believed to be a small *Spelerpes ruber,* but closer inspection proved it to be otherwise. The head, sides and back are of uniform coral red, gradually fading into pinkish on the immaculate belly (Fig. 7). The sides and the dorsum of the distal half of the tail are heavily mottled with black, leaving the dorsal line of the proximal half the same color as the body. The mottling extends upon the ventral side of the tail, but the spots are here much lighter so that the general pink color of the under parts is evident. On the right side the black blotches of the tail begin immediately behind the leg, while on the left the base of the tail is an immaculate red for some distance behind the leg.

This specimen was found under a piece of bark in a dry and rather open woodland. About three weeks later in a nearby locality there was found a second specimen which upon comparison proved to agree in all essential respects of coloration with the first. This one escaped before it was killed and preserved.

On April 27, 1907, near Beesemer, N. Y., a short distance south of Ithaca, Mr. Allen found another specimen[2] (Fig. 6) which is identical in form and similar in coloration to those taken near Buffalo. The Beesemer specimen is a carrot red with a cluster of minute black dots on the top of the head and a row of similar dots along the sides of the back in a position which corre-

[1] No. 5,047 Cornell University collection.
[2] No. 5,048 Cornell University collection.

sponds to the dorsal portion of the black lateral band in *Plethodon cinereus erythronotus*. This row of dots is broadest above the region of the arm, whence it is gradually reduced as the leg is approached. The coloration of the tail is similar to that of the Buffalo specimen excepting that the black color, instead of being collected in blotches, is more diffuse and continuous with the same color in the trunk region.

When these specimens were examined more closely they were found to have the body proportions and all of the structural features of *Plethodon cinereus*.

In the Cayuga Lake Basin both *Plethodon cinereus cinereus* and *P. c. erythronotus* are abundant and great variation with regard to coloration has already been noted. Several hundred specimens, mostly from this region, were examined with a view to determining the extent of the variation in coloration. This resulted in the selection of a series of fifteen individuals, of practically the same size, which show a fairly complete transition, in regard to coloration, between the typical *Plethodon cinereus cinereus* and the red forms taken near Buffalo. The middle of the series is occupied by a typical *P. c. erythronotus* (Fig. 4). From this variety the coloration in one direction grades into *P. c. cinereus* and in the other into the red form.

Cope[3] describes the variety *erythronotus* as follows:

"A broad light-reddish stripe commences at the nape of the width of the interorbital space, and continues to the tip of the tail, on which it diminishes gradually in width. The central region of the stripe generally exhibits a very fine mottling of brownish, scarcely obscuring the effect of the red ground. The mottling is sometimes equally distributed—sometimes concentrated in some places more than others. The sides of the body are abruptly and continuously dark brown, but soon fade off below into the pepper and salt of the lower sides and belly. . . . The color of the red stripe varies considerably. Sometimes it has a shade of pink—sometimes of orange or yellowish."

In all individuals examined from this region the red dorsal stripe on the tail grows narrow very rapidly. The

[3] Cope, E. D., "The Batrachia of North America," Bull. 34, U. S. Nat. Mus., p. 135.

distal third is mottled so heavily with black that the stripe, as such, is lost. The large number of specimens examined indicates that the typical *P. c. erythronotus* is not more common here than the red intermediates.

The transition between the variety *erythronotus* and the red form is accomplished thus: the red dorsal stripe first extends cephalad covering the whole top of the head where there is found in all intermediates a sprinkling of brown dots (Fig. 5). It then invades the sides of the head passing to the snout underneath the eyes. From this position it spreads in all directions, replacing the brown until the whole body is thoroughly suffused with red. In such specimens the brown color-pattern is evident but subdued by the red tone due to the invasion of this color into the whitish areas between the clusters of brown blotches.

The further transition consists in the expansion of the red ground-color and the gradual reduction of the brown blotches which persist longest on the top of the head, along the dorsal abrupt border of the lateral band, down the middle of the back and on the tail. In the Beesemer specimen only the vestiges of the brown markings remain in the regions just mentioned. On the limbs the invasion of red proceeds from the base towards the extremity, the brown markings showing longest upon the hands and feet.

In the Buffalo specimen the brown markings are everywhere apparently obliterated excepting upon the tail, the snout and the region between the eyes and a cluster just behind and below the left eye. In the alcoholic specimen there are revealed, along the sides of the back in the shoulder region, very fine specks of brown pigment arranged in a narrow band which can be traced to the leg region, although the dots are faint and much scattered in the caudal half, and in the living specimen did not show at all.

According to Cope[4] intermediate specimens between

[4] Cope, *op. cit.*, p. 136.

the varieties *erythronotus* and *cinereus* are uncommon, for he says:

"Among the very great numbers of specimens which I have examined in the collections of the Smithsonian Institution, The Academy of Natural Sciences and Essex Institute I have observed but four specimens of the red-banded variety and four of the gray which could be regarded as intermediate in character."

In the material at hand I find that the intermediate individuals, between the varieties just named, are fairly numerous; so that a series was selected which forms almost an insensible transition from the one to the other. The method here is exactly the reverse of that described above in connection with the red forms; *i. e.*, the red is replaced by brown. In describing the intermediate specimens which he studied, Cope outlined the method which I find carried out in detail in my material. He writes:

"This [the intermediate character of his specimens] appears in a rufous cast in the dorsal color of the latter [variety *cinereus*] and a slight obliteration of the borders of the dorsal band in the former [variety *erythronotus*]."

The brown of the lateral band in *P. c. erythronotus* begins first to encroach upon the red of the dorsal stripe so that its edges become scalloped (Fig. 3). This spreading of the brown color continues until the dorsal stripe is heavily blotched and the red becomes very dull (Fig. 2). Then the brown blotches gradually coalesce, in consequence of which the red stripe, as such, is obliterated, yet enough of the red pigment remains to give the effect of a dull liver-brown to the back of *P. c. cinereus*. In a number of specimens of this variety all traces of liver-brown have disappeared, rendering the back uniform in coloration with that of the sides (Fig. 1).

In respect to structural characteristics no variations were detected except in the case of one red intermediate where only seventeen costal grooves were present. The body proportions of this individual were slightly less than the others.

Data bearing upon the relation of this variation to environment, food, moisture, etc., are entirely wanting. The red specimen taken near Buffalo was at an altitude of 1,000 feet above sea level. That near Beesemer, 800 feet. Individuals kept in the terrarium under entirely different conditions than those from which they were taken in nature never change in coloration so far as I can determine, which indicates that the variation is independent of the nervous system. The age of the individual seems to have no relation to variation. Among adults of all sizes the different intermediate forms are found. There are in the collection of Cornell University about a dozen specimens taken soon after transformation. They are all typically of either the variety cinereus or erythronotus except one which varies decidedly towards the red form.

EXPLANATION OF PLATE.

FIG. 1. *Plethodon cinereus cinereus* in which all traces of the dorsal stripe have disappeared.
" 4. *Plethodon cinereus erythronotus.*
" 6. The red specimen taken near Beesemer, N. Y.
" 7. The red specimen taken near Buffalo, N. Y.

The other figures, according to their position, are intermediates between *P. c. cinereus, P. c. erythronotus* and the red Buffalo specimen.

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